



Policy Toolkit for Carpet Circularity in EU Member States

Report to Changing Markets

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Report for Suzanne Schenk, Changing Markets

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Executive Summary

Carpet is a very significant EU waste stream with around 1.6 M tonnes arising each year as waste.¹ Most carpets are made primarily from finite resources in the form of oil-based plastics that could be recycled and yet recycling rates are less than 3% in the EU and reuse rates an even smaller fraction.² There are also significant concerns about the hazardous substances they contain and the impact these can have on indoor air quality and health. There is therefore a huge opportunity to reduce the environmental and health impact of carpet and recover far more of the resources they contain.

The carpet sector is also an important one economically. The EU is the second biggest market in the world for carpet after the US, as well as being one of the largest producers: Belgium, the Netherlands, and the United Kingdom are the EU's leading manufacturing countries. Overall around 65% of EU demand for carpets is fulfilled by EU-based manufacturing (high compared to other textile products), creating jobs in leading companies such as Associated Weavers (BE), Balta (BE), Beaulieu International Group (BE), Brintons (UK), Forbo (NL) and Tarkett (FR, and its subsidiary Desso, NL). Greater circularity offers to bring even more jobs to this important sector, replacing a small number of jobs in incineration and landfill with far more jobs in closed-loop recycling for example.³

Despite all this, there are no policy instruments helping to drive greater circularity at the EU or Member State level and hence an opportunity to fill that gap, so as to accelerate progress towards more sustainable production and end-of-life management of carpets placed on EU markets. The vision is that by 2025 all commercial and household carpets (broadloom and tiles) put on the market pose no health risk and are separately collected, reusable and fully recyclable – as a result carpet recycling rates are steadily increasing.⁴ It is worth noting that closed-loop recycling will only happen as better-designed carpets gain market share.

This Toolkit, aimed at governments of EU Member States, suggests a wide variety of policy instruments with Extended Producer Responsibility (EPR) as a key element. Although the purpose of this Toolkit is to provide guidance to national governments, many of these measures could be effectively applied at the EU level as well or in

¹ Toxics in Carpets in the European Union, Anthesis for Changing Markets, March 2018

² Detoxing Carpets; EPHA/HEAL, March 2018 - original source studies: <http://changingmarkets.org/wp-content/uploads/2017/04/German-Carpet-Report-ENG.pdf> and <http://changingmarkets.org/wp-content/uploads/2017/04/French-Carpet-Report-English.pdf>

³ Economic Growth Potential of More Circular Economies, WRAP, 2015

⁴ Separate collection is a key aspect to enable proper recycling in opposition to mixed collection which increases contamination of materials. We are aware that 100% collection rate will not be possible and we will need to set targets, however as a vision we want to aim at capturing all carpets.

collaboration with several governments. Member States will no doubt vary in what they feel able to progress in the short to medium term and hence the Toolkit offers options on the supply side (waste management and market 'push') and the demand side (market 'pull'), that might be used together, varying depending on the level of ambition.

Two policy packages are suggested by way of showing how policy instruments could be combined. Package 1 provides a fully mandatory EPR-led approach, designed to meet the needs of Member States with the highest Circular Economy (CE) ambitions. EPR is used here not only as a vehicle to deliver and pay for high levels of recycling, but also to provide a meaningful incentive for better design through modulated fees, working to supplement minimum eco-design 'essential requirements'. Other instruments are suggested to help drive demand, including a Green Carpet Mark to provide clear consumer information and mandatory Green Public Procurement.

Package 2 is suggested as an alternative to, or precursor to, Package 1 where an EPR approach is not immediately possible, using additional 'essential requirements' rather than modulated EPR fees to drive eco-design and mandatory take back and taxes being used to respectively facilitate and pay for the waste management aspects. The demand side instruments remain as for Package 1.

The main body of the Toolkit provides further in-depth explanation of the individual policy measures and discussion around the rationale for these various policy options and how they might best be applied.

By applying these measures, governments can seize the circular economy opportunity that exists in this sector and set a precedent for other sectors. The benefits of implementing these measures are in moving carpet waste up the waste hierarchy, with an associated reduction in GHG emissions which will enable governments to more easily reach their EU targets, reduced toxicity of carpets, which will improve indoor air quality and improve health, and creation of new employment opportunities.

Package 1: Fully Mandatory with EPR

Mandatory eco-design measures – minimum ‘essential requirements’ (ERs) to:

- Phase out all hazardous materials/substances
- Provide a minimum five year warranty
- **Set minimum recycled / organic content levels** ⁵
- **Set minimum recyclability requirements** ⁵
- Provide ‘product passports’ to assist recyclers, collectors etc.
- Mandate installation techniques that allow easy removal

Mandatory Extended Producer Responsibility (EPR) with:

- Mandatory and progressive ‘preparing for reuse’ and recycling targets, with producers covering the full costs of collections for consumers and proper treatment.⁶
- Modulated producer fees, to reward eco-design going beyond the minimum ‘essential requirements’, and penalise sub-optimally designed products, to reflect negative health and environmental impacts.
- Support initiatives for CE innovation in the sector, combined with tax breaks, grants and/or low interest loans for CE carpet manufacturers and carpet recycling companies.

Mandatory Green Carpet Mark (GCM) grading and labelling to give full transparency on eco-design features to help inform purchasers (public and private) with an A to G rating (G = mandatory to meet the ‘essential requirements’ minimum) or similar (e.g. bronze, silver, gold).

Mandatory Green Public Procurement (GPP) linked to the GCM to drive demand for more sustainable carpets with common criteria and minimum GCM level required (e.g. C or B rating).

Consumer information campaigns to support separate collection and understanding of the GCM.

⁵ Note that these two ERs could potentially be dropped where the EPR modulated fee and recycling targets in combination are deemed sufficient to drive change

⁶ Note that ‘preparing for reuse’ is the legal term used for sorting and refurbishment to allow reuse whereas direct reuse is where the item never becomes waste and is simply passed on with that intention.

Package 2: Part Mandatory – Without EPR but With Incentivised Collection

Mandatory eco-design measures – minimum ‘essential requirements’ to:

- Phase out all hazardous materials/substances
- Provide a minimum five year warranty
- Set minimum recycled content / organic content levels
- Set minimum recyclability requirements
- Provide ‘product passports’ to assist recyclers, collectors etc.
- Mandate installation techniques that allow easy removal

Mandatory take back, or a Deposit Refund Scheme (DRS), for carpet tiles and events carpets to encourage return for reuse and recycling, combined with free ‘bulky waste’ collection at the municipal level for residential carpet where it is deemed reusable or recyclable.

Progressive national targets⁷ for ‘preparing for reuse’ and recycling, with taxes on new carpet (and possible incineration) to cover the costs of collection and treatment.

Support initiative for CE innovation in the sector, combined with tax breaks, grants and/or low interest loans for CE carpet manufacturers and carpet recycling companies.

Mandatory use of the Green Carpet Mark (GCM) grading and labelling to help inform purchasers (public and private) with an A to G rating (G = mandatory to meet the ‘essential requirements’ minimum) or similar (e.g. bronze, silver, gold).

Voluntary GPP, but with reference to a minimum standard under GCM (e.g. C or B rated).

Consumer information campaigns to support separate collection and understanding of the GCM.

⁷ Note these are not the producers responsibility – hence the absolute need for recyclability requirements to be added to the ERs

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1.0 Introduction

1.1 What is this Toolkit about and who is it for?

Carpet is a very significant EU waste stream with around 1.6 M tonnes arising each year as waste.⁸ Most carpets are made primarily from finite resources in the form of oil-based plastics that could be recycled and yet recycling rates are less than 3% in the EU and reuse rates an even smaller fraction.⁹ There are also significant concerns about the hazardous substances they contain and the impact these can have on indoor air quality and health; and yet there are virtually no policy instruments helping to drive greater circularity at the EU level.

This Toolkit paper therefore sets out a range of policy options to assist Member States in taking a lead on this important product group, helping to fulfil the huge Circular Economy potential that carpets have and offering an example for others to follow; at the EU level and beyond.

While Extended Producer Responsibility (EPR) is one key element, other policy options are also suggested to drive:

- progress on eco-design to facilitate reusability and recycling and where possible a reduction in the carbon and wider life cycle impacts of the materials used (e.g. through the use of substitute and recycled content materials, where they present no hazard);
- a reduction and ultimately complete removal of toxic components within the carpets themselves (which may also restrict the use of recycled materials in the transition phase, when there are risks associated with legacy chemicals);
- improved environmental management at end of life – i.e. collection, sorting and reprocessing (which may also be impacted by carpet fitting techniques); and
- an accompanying shift in the financial burden away from taxpayers/citizens to producers/consumers.

The Toolkit offers two packages of policy options depending on the level of Member State ambition, but ensuring that there are both ‘push’ (supply side) and ‘pull’ (demand side) mechanisms to overcome the market failures on both sides of the equation. The intention is not to focus on voluntary initiatives but rather to focus on mandatory, or at

⁸ Toxics in Carpets in the European Union, Anthesis for Changing Markets, March 2018

⁹ Detoxing Carpets; EPHA/HEAL, March 2018 - original source studies: <http://changingmarkets.org/wp-content/uploads/2017/04/German-Carpet-Report-ENG.pdf> and <http://changingmarkets.org/wp-content/uploads/2017/04/French-Carpet-Report-English.pdf>

least part mandatory options, to drive progress more quickly and reduce barriers to the circular economy that are outside of the control of the carpet industry.

1.2 Why bother with Carpet Waste?

Carpet is heavy, often contaminated and currently difficult to recycle with rates across the EU at around 3%, with even lower levels of reuse. In the UK events industry alone it is estimated that 12,000,000 m² of lightweight disposable carpet is used each year and most of that is thrown away after only a few days of use, with an estimated 30,000 tonnes of carpet waste across the EU.¹⁰

There are no current recovery targets for carpets and while there are some high-profile, manufacturer-operated carpet takeback programmes in place in Europe, the return volumes are tiny in comparison to the total carpet waste volumes. Although there are construction and demolition waste targets, the low weight of carpets in this mixed waste leads to a situation where the actual recycling of the carpets is completely irrelevant for the achievement of those targets.

Where diversion from landfill does occur it is largely to energy from waste (an inefficient and dirty process even compared to gas fired generation), while the recycling is generally down-cycling into lower specification uses such as surface material for horse paddocks and padding for furniture and mattresses. This is largely due to the multi-material design of the carpets, with most consisting of a heavy backing of latex-based adhesives and filler materials holding together several polymers or polymer-wool combinations in the face fibre (pile) and primary weave backing.

Carpet is also problematic in that it often containing hazardous substances of various kinds in the backing and various chemical treatments (e.g. stain preventatives). A recent report for Changing Markets identified a list of 59+ toxic substances used in carpets sold on the EU market. This list of substances includes phthalates, perfluorinated compounds (PFASs), flame retardants and toxic heavy metals. Many of the chemicals found in carpets may volatilize and/or migrate from carpets through typical use and abrasion of carpet as well as adhere to dust – making dermal, inhalation, and ingestion exposure to their toxic effects all possible.

The carpet sector is also an important one economically. The EU is the second biggest market in the world for carpet after the US, as well as being one of the largest producers: Belgium, the Netherlands, and the United Kingdom are the EU's leading manufacturing countries. Overall around 65% of EU demand for carpets is fulfilled by EU-based manufacturing (high compared to other textile products), creating jobs in leading companies such as Desso (NL), Tarkett (FR) and Brintons (UK). Greater circularity offers to bring even more jobs to this important sector, replacing a small number of jobs in

¹⁰ Toxics in Carpets in the European Union, Anthesis for Changing Markets, March 2018

incineration and landfill with far more jobs in preparing for reuse and recycling for example.¹¹

As a result of these issues, there is a need to accelerate a move towards more sustainable production and end-of-life management of carpets placed on the EU markets. The vision is that by 2025 all commercial and household carpets (broadloom and tiles) put on the market pose no health risk and are separately collected, reusable and fully recyclable – to a quality level that allows for carpet to carpet recycling or equivalent high value uses.¹² It is worth noting that high value and closed-loop recycling will only happen as the sales of better-designed carpets gain market share.

Further background information on the current state of play in regards to carpet circularity in the EU is provided in Appendix A.1.0.

Box 1: Good Eco-Design for Carpets

What can be considered ‘good’ eco-design is important in terms of setting eco-design criteria in various policy instruments from EPR to Green Public Procurement. The following points are what can be considered key to a more ‘circular’ carpet design:

Low toxicity materials:

- Zero known hazardous substances (<http://chemsec.org/sin-list/>) including substances of very high concern (SVHCs) under REACH

The use of sustainable/low-impact materials:

- Natural materials such as wool, jute and sisal
- Recycled plastic content (where legacy toxins can be eliminated); and potentially
- Bio-based materials – often preferable in carbon terms but can be problematic in terms of land take and other life cycle impacts.

Durability:

- Wool and nylon carpets are the most hard-wearing carpets (they can be used for 15 years or more with regular cleaning)
- Woven loop-pile carpets are more hard-wearing than tufted carpets
- Dark and mixed colour carpets and those with random patterns are less likely to be ruined by small stains
- Carpet tiles allow easy replacement of work or damaged areas, extending the life of the carpet as a whole
- Carpet tiles with open cell cushion backing are more durable than those with rigid or closed-cell backing.

Reuse:

¹¹ Economic Growth Potential of More Circular Economies, WRAP, 2015

¹² Separate collection is a key aspect to enable proper recycling in opposition to mixed collection which increases contamination of materials. We are aware that 100% collection rate will not be possible and we will need to set targets, however as a vision we want to aim at capturing all carpets.

- Tile designs, and their size, make them easier to store and reuse than broadloom carpet, although reuse is not widely practiced
- No-glue installation carpet tile facilitate reuse since the tiles are not damaged in removing them (systems such as the Interface TacTile and TarkettTape™)

Recyclability (maximising fibre recovery and high-value uses):

- Single polymer design – face fibres and backing
- Easily separable face fibres and primary backing from secondary backing (sometimes called cushioning)
- Use of materials for which closed loop recycling is possible
- Detailed information on the composition (materials and additives)
- Elimination of hazardous substances
- Easy installation and removal methods (without the use of permanent adhesives)

Several companies offer products with many of these features already, but the development of a level playing field for these and the required mainstream market scale has not yet been achieved. To give some examples:

Reeds Carpets (UK)¹³ make 100% PP carpets for trade events and exhibitions without a secondary backing and take this back and recycle it, although they are not thought to reuse the carpets. Mohawk Everstrand Carpet claims to be engineered from one type of recycled PET and can also be recycled¹⁴ while the Mohawk Air.O, an entirely PET-based carpet, claims to be latex and VOC free and fully recyclable.¹⁵ Donkersloot (working with DSM-Niaga) have developed a carpet with an adhesive that allows reversible (heat-based) separation of the primary from the secondary backing).¹⁶ The Desso Ecobase® tile uses a polymeric backing to increase recyclability and Desso also use Aquafil Econyl recycled nylon from old fishing nets as well as used carpets.

2.0 The Toolkit

2.1 Some Definitions

Carpet means wall-to-wall textile floorcovering (excluding rugs), broadloom and tile, both commercial and private, made of plastics based materials, wool and other natural fibres. The scope of this toolkit also includes carpet underlay and secondary padding, i.e. not permanently attached to the carpet itself.

¹³ <http://www.reeds-carpets.co.uk/services/recycling/>

¹⁴ <https://www.mohawkflooring.com/carpet/brand/everstrand>

¹⁵ <http://www.floordaily.net/floorfocus/mohawk-introduces-airo-100-recyclable-easy-to-install-floorcovering-jan-2017>

¹⁶ <http://www.donkersloot-tapijt.nl/Circulair-tapijt.html>

Producers means manufacturers, importers, retailers and online multi-seller platforms (the last where the retailer is in another country) – whichever places the product on the market for the first time.

The following three definitions are taken from the Waste Framework Directive:

Prevention: Measures taken before a substance, material or product has become waste that reduce:

- the quantity of waste, including through the re-use of products or the extension of the life span of products;
- the adverse impacts of the generated waste on the environment and human health; or
- the content of harmful substances in materials and products.

Reducing the amounts of waste can be called quantitative waste prevention, reducing the content of harmful substances can be termed qualitative waste prevention.

Preparing for re-use: Checking, cleaning or repairing recovery operations, by which waste, products or components of products that have been collected by a recognised preparation for re-use operator or deposit-refund scheme are prepared so that they can be re-used without any other pre-processing.

Recycling: Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material [i.e. composting and anaerobic digestion] but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations.'

Closed-loop Recycling: In terms of recycling, it is important that this is into materials that are of approximately the same value as the original material, in a closed-loop back into carpet fibres, or in some cases open-loop, for example into textile fibres or other consumer products. Down-cycling into low value materials should be avoided since the environmental benefit is often poor by comparison.

2.2 Extended Producer Responsibility and Related Policy Instruments

2.2.1 EPR form and principles

The EPR systems developed over the last 20 years (e.g. for Packaging, WEEE, ELVs) have been effective up to a point in covering at least part of the costs of collection and treatment of products once they have become waste. However, cost-coverage has often been incomplete and there has been little to incentive better product design; individual producer responsibility (whereby the producer deals with its waste obligations directly) has been impractical and eco-modulation (using variable EPR fees to reflect the environmental benefits of a product) rarely used.

A new carpet EPR system would be part of a second generation of EPR legislation – making producers truly responsible for the products they place on the market, creating

secure revenue streams for collection and recycling infrastructure to operate effectively and to incentivise product innovation towards better design, with penalties for less sustainable practices. As such EPR for carpets would mean that EPR fees are not just seen as a way to pay for recycling or disposal but rather provide a meaningful incentive for better design and closed loop (circular) practices with high quality recovered materials.

There are a number of key principles that should apply to any carpet EPR system and supporting instruments in the EU. The system should:

- Shift the cost burden from municipalities and taxpayers to producers (manufacturers, importers, distributors) and consumers of the products
 - Increase reuse / preparing for reuse and recycling rates in a progressive fashion
 - Create a relatively secure financial stream to allow waste companies and recyclers to develop the required infrastructure
 - Physically provide, or cover the full cost of, primary and secondary collection and 'proper' treatment to meet targets
 - Reward good Design for Sustainability (DfS), including health considerations, and penalise poor design
 - Reward reuse and CE models
 - Help to create demand for the secondary materials from recycling
 - Help to stimulate the EU economy and create jobs in the EU
- Be mandatory and limit 'free-riding' as far as possible

Article 8a of the new Waste Framework Directive (WFD) now enshrines several of the above principles as minimum requirements for EPR under EU law and any new EPR legislation at the Member State level should align with these requirements.¹⁷ Some key aspects are highlighted in the box below for EPR in individual Member States.¹⁸

Box 2: EPR Minimum Requirements in the EU under the WFD

Article 8a (4) states:

Member States shall take the necessary measures to ensure that the financial contributions paid by the producer of the product to comply with its extended producer responsibility obligations:

cover the following costs for the products that the producer puts on the market in the Member State concerned:

costs of separate collection of waste and its subsequent transport and treatment, including treatment necessary to meet the Union waste management targets, and costs necessary to meet other targets and objectives as referred to in point (b) of paragraph 1,

¹⁷ DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2008/98/EC on waste; Brussels, 27 April 2018

¹⁸ See <http://data.consilium.europa.eu/doc/document/ST-6516-2018-INIT/en/pdf>

taking into account the revenues from re-use, from sales of secondary raw material from its products and from unclaimed deposit fees;

costs of providing adequate information to waste holders in accordance with paragraph 2;

costs of data gathering and reporting in accordance with point (c) of paragraph 1.

This point shall not apply to extended producer responsibility schemes established pursuant to Directives 2000/53/EC, 2006/66/EC or 2012/19/EU;

in the case of collective fulfilment of extended producer responsibility obligations, are modulated, where possible, for individual products or groups of similar products, notably by taking into account their durability, reparability, re-usability and recyclability and the presence of hazardous substances, thereby taking a life-cycle approach and aligned with the requirements set by relevant Union law, and where available, based on harmonised criteria in order to ensure a smooth functioning of the internal market; and

do not exceed the costs that are necessary to provide waste management services in a cost-efficient way. Such costs shall be established in a transparent way between the actors concerned.

Perhaps the most important points here for carpet EPR are that the costs of separate collection should be borne by producers and that fees should be modulated in accordance with Circular Economy principals. These principles have been integrated into the policy options described in this toolkit.

This last paragraph suggests that only ‘market costs’ associated with waste collection and management/treatment can be covered under EPR rather than wider ‘non-market costs’, although there are signs that these principles are expanded beyond only ‘markets costs’, for example it is worth noting that the costs of litter clean-up is covered under the draft Single Use Plastics Directive. A parallel would be to cover carpet fly-tipping costs under any national legislation. It is also recommended that, where possible, a monetised reflection of all environmental and health externalities are included in the modulated EPR fees to create a level playing field and enable scaling up of clean waste streams.

2.2.2 Individual Producer Responsibility and Export

EU EPR law (for example the WEEE Directive) always allowed for, and indeed encouraged, individual producer responsibility (IPR), whereby the cost of dealing with a producers own specific products would be charged back to that producer, hence (when combined with high recycling targets) encouraging design for recyclability so as to reduce the net cost of compliance. This can be done through a collective system, where the individual producer costs can be identified and charged back, or through a closed loop take-back system, where the producer makes its own arrangements for its own products. The latter is only really feasible for recovery of B2B carpets (e.g. tiles and events carpets).

Most carpets in the B2C market are sold via retailers and carpet fitters and the end of life carpets often end up in mixed loads of general waste. Were carpets to be separately

collected under EPR, at household waste recycling centres (B2C) and on renovation and construction sites (B2B) for example, there would still be a mixed load of carpet of all kinds and origins, similar to the way in which mixed loads of WEEE are collected today under EPR. The collection and treatment costs would thus be for those mixed loads and identification of the relative costs of treatment, for 'good' and 'bad' carpet design, and tracing back to the individual producer would currently be very complex and inefficient; although the latest tracking technologies are beginning to make this a more practical proposition.

Consequently most EPR systems today operate on the basis of collective rather than individual responsibility. This is to say that producers pay fees to a Producer Responsibility Organisation (PRO) according to the amount of product/packaging they place on the market, picking up their share of the costs of treating the collected wastes from all sources. Collective systems provide economies of scale but do not necessarily incentivise good design. There is no incentive for any one company (even with a sizeable market share) to 'go further' than any other, unless of course there is some other incentive or market advantage to making a more 'eco-friendly' carpet. The EPR fees in such a case simply cover costs without necessarily incentivising improvement.

Moreover there is the problem of orphan carpet, whereby carpet that arises as waste, potentially 20 years or more after it was sold, has no remaining legal producer that can pick up the cost under a collective scheme. In this instance, as with WEEE, others in the collective system have to pick up these additional orphan costs.

A good EPR system is therefore a combination; one where there is the option of collective responsibility for collection and treatment, but also with individual producer incentives to drive better design. Modulated fees offer one way of doing this while Essential Requirements are a more direct mandatory approach to impact design. It should be noted, though, that with Essential Requirements alone, the costs for treatment and collection of waste are not covered by producers. Given that carpet is a long-lived product, the design changes will only start to filter through around a decade after the Essential Requirements come into force. In the meantime there is the question as to as to who will pick up the bill for to ensure collection and recycling (of waste with potential chemicals of concern) in the short term.

There is also the question of whether waste exports should be allowed, particularly outside the EU but also to EU countries with poor waste management controls/derogations, for example on landfill dumping. In many EU EPR systems, much of the obligated waste has been exported (in particular to the Far East) as reprocessing can be done more cheaply overseas and the markets for secondary materials have been strong. This is problematic in several ways. Firstly this means that fewer facilities are developed in the EU and economic growth and job creation is reduced. Secondly it can be difficult to audit practices overseas to ensure that bogus reprocessing is not occurring. Thirdly the transport of waste, particularly in its bulky un-reprocessed state, reduces the benefit of recycling (due to transport impacts).

It should be noted that few carpets leave the EU due to its high calorific value (for use in EfW plants in the EU), and the cost of transporting heavy, low quality material. A ban on

exports would make sense, however, to avoid a surge in export if progressive restrictions were placed on the use of landfill and EfW for carpet disposal.

2.2.3 Essential Requirements

Before defining the proposed aspects of the EPR system for an Individual Member State, it is helpful to define the minimum product requirements that should be specified to allow that product on the market of an EU Member State.

European producer responsibility legislation, and indeed other product legislation covering items such as toys and medical devices, is often accompanied by a list of ‘essential requirements’ for the products to be CE marked and allowed on the European single market. These requirements define the minimum characteristics of that product, often in terms of safety and environmental issues. Floor coverings must comply with the Construction Products Regulations (CPR (EU) No 305/2011) and EN 14041 specifies the health, safety and energy saving Essential Characteristics (ECs; i.e. essential requirements) for resilient, textile and laminate floor coverings.

While there is a potential single market problem with having tighter standards in one country than another within the EU, these ECs do not cover most of the considerations of interest and in some cases are voluntary anyway at the EU level. We understand that it should be possible for national rules to apply where there is no mandatory EU standards. It is worth noting that several EU countries have imposed tighter product requirements than are present at the EU level (e.g. UK banning of microbeads in cosmetics where there is no restriction at the EU level; the older Swedish ban on products containing mercury).

Assuming that there is no free market issue, mandatory minimum eco-design aspects for carpets can, therefore, be delivered through ‘Essential Requirements’ within any national EPR legislation.¹⁹ More ambitious good practice elements could be incentivised through modulated fees, GPP and labels for consumers. If there is a future EU approach, and carpets are covered by the Eco-Design Directive or by ‘Essential Requirements’ under EU carpet EPR, it would be more complicated for MS to take more stringent measures than those at the EU level; although chemical restrictions could still potentially be dealt with as a matter of national health policy (something over which Member States have separate jurisdiction).

It is also worth noting that WTO and EU rules do allow members to derogate from their free trade obligations in some cases, for instance where a measure is aimed at the conservation of natural resources. A more significant barrier could be one of Member State concern over exports, whereby tighter standards could make EU carpet more costly and hence less competitive elsewhere.

¹⁹ It is worth noting that another option at the EU level, is the extension of the Eco-design Directive to other product groups beyond energy-using products.

As regards EPR modulated fees, Member States are much freer, and while using EU-wide criteria would be preferred, a MS can still decide its own modulation criteria which could serve as a starting point to build up an eco-modulation system across the EU. Even where later EU criteria area defined, a national EPR scheme could still add extra criteria where more demanding for environmental protection purposes. The revised Waste Framework Directive notes that (Article 8a):

“... in the case of collective fulfilment of extended producer responsibility obligations, are modulated, where possible, for individual products or groups of similar products, notably by taking into account their durability, reparability, re-usability and recyclability and the presence of hazardous substances, thereby taking a life-cycle approach and aligned with the requirements set by relevant Union law, and where available, based on harmonised criteria in order to ensure a smooth functioning of the internal market.”

The revised WFD also notes that:

“Where necessary to avoid distortion of the internal market, the Commission may adopt implementing acts in order to lay down criteria with a view to the uniform application of point (b) of Article 8a(4), but excluding any precise determination of the level of the contributions [under modulated fees].”

The following minimum ‘essential requirements’ are suggested as a simple set which are least likely to result in EU market distortion concerns. These are complimented by the modulated fee factors noted in Section 2.2.9.

It is important to note that, given the relatively long life of carpets, the reduction/elimination of hazardous substances use is very urgent if closed-loop carpet recycling is to be increased in the medium term without the risk of perpetuating the use of the legacy chemicals in the recycled materials. This is taken into account in the suggested timeline, to allow sufficient time for the market to adjust to the requirements.

Box 3: Proposed Essential (minimum) Requirements for Carpet

Hazardous Substances:

A ban on the following, in new carpets and carpet treatments (maximum concentration limits as applied to treated carpet as fitted), by 2022, whilst maintaining safety requirements:

- All intentional use of SVHCs as defined by REACH Article 57 and included on the so-called ‘Candidate List’ and the ‘Authorisation List’ (Annex XIV) not to exceed 0.1% w:w concentration (1000ppm) when tested and 0.01% (100ppm) for Class 1 and 2 carcinogenic, mutagenic and reprotoxic (CMR) substances under the EU CLP Regulation 1272/2008. For avoidance of doubt this list is to include all relevant PFOAs and PFOSs, phthalates, azo dyes, heavy metals, organotins, isocyanates, anti-microbials and flame retardants.

And a ban by 2025 of:

- All intentional uses of chemicals currently listed under the Sin List of chemicals²⁰ not to exceed 0.1% by weight concentration (1000ppm) when tested and 0.01% (100ppm) for Class 1 and 2 carcinogenic, mutagenic and reprotoxic (CMR) substances under the EU CLP Regulation 1272/2008.

Recycled Content:

- A minimum 20% of the plastic carpet fibre materials by weight need to be from post-consumer sources and 20% of the natural fibres from organic sources by 2022, and at least 40% by 2025.
- Virgin PVC and bitumen are phased out in carpet manufacturing as soon as technically possible, and carpet manufacturers using recycled PVC or bitumen in their products screen the feedstock to ensure toxic additives, such as phthalates, are not recycled back into the system.

Durability (minimum warranty):

- Carpet to be offered with a mandatory minimum all-inclusive wear and tear warranty from the producer with a period of 5 years, but with warranty claim exemptions for inappropriate use and damage.

Recyclability:

- At least 70% of the materials by weight should be readily separable and recyclable materials by 2022 increasing to at least 90% readily separable and recyclable materials by 2025.

Labelling:

- Mandatory product passport information for PROs and recyclers by 2022 – including the name and contact details for the manufacturer, year of manufacture, place of manufacture, full disclosure on the carpet composition (i.e. face fibres, primary and secondary backing/cushioning materials and construction, including adhesives etc.), and all chemical substances used.
- Mandatory Green Carpet Mark (GCM) labelling for consumers to be shown clearly at the point of sale and for consumers to take away.

Installation:

- By 2022, no use of permanent adhesives in bonding carpet to a floor so as to allow the carpet to be removed at end of life without significant damage. Clear standards and guidelines, if not mandatory regulation, should be used to ensure that carpet, including carpet tiles, can be easily removed at end of life.

2.2.4 Producer Responsibility Organisations and Registration

One or more PROs should be established and authorised by the national authorities (e.g. environmental ministry or environmental protection agency) to take on the collective

²⁰ <http://chemsec.org/business-tool/sin-list/>

responsibilities of the producers. Registration should be obligatory with a PRO unless the producer offers take-back of carpet on the sale of a new carpet at no extra cost (at least explicitly) and complies with all other regulations (targets, essential requirements etc), in which case registration should be with the national authorities (e.g. environmental agency).

2.2.5 Collection and Take-Back

Collection from households (as bulky waste), businesses and designated carpet collection points (e.g. household waste recycling centres) should be free of charge to the consumer - with the collection and administration costs covered by the relevant PRO or via the producer or their designated contractor where take-back is provided for; take-back being at the store or via the new carpet fitter or building contractor. Carpets should be separately collected to avoid contamination from other waste streams.

It is worth noting that some manufacturers are already providing free take back in the EU, e.g. Tarkett and Interface, and take back for reuse and recycling is part of the New Zealand eco-label for carpet.²¹

2.2.6 Reuse

CE business models, including leasing and other product service models, should be encouraged, as a minimum for event carpets and tiles, to help drive demand for more durable and sustainable carpets. This could be driven by GPP. Free and segregated carpet collection for consumers, e.g. the sorting of bulky waste, can also open-up options for second-hand-carpet sales.

As another incentive, reuse and leasing, either directly or after 'preparing for reuse', would not be considered as placing on the market and hence would be exempt from charges based on market share. This is the way that reuse is encouraged under the UK producer responsibility regulations for packaging for example.

2.2.7 Targets

As with the WEEE Directive, targets would be defined in relation to the average of the previous three years of carpet placed on the market by area (m²). The progressive targets will drive the development of infrastructure, when combined with an export ban for recovery (including recycling) outside of the EU. Such a ban would be recommended.

²¹ <https://environmentalchoice.org.nz/products-and-services/>

Table 2-1: Progressive Target Rates

% Rates	2025	2030	2035	2040
Recycling	15	35	60	75
Of which back into fibres for carpet or equivalents, e.g. textiles manufacture	10	20	40	50
Preparing for Reuse	5	10	15	20
Other Recovery	30	20	10	5
Total diversion	50	65	85	100

Notes: the closed loop recycling rates (in blue) follow a lower trajectory than the overall rates to allow flexibility in finding suitable markets for the recycle. The timeline here is ambitious but aims to allow sufficient time for the market to adjust to the requirements. The dates for the initial chemical changes are 2022; three years in advance as this matter is urgent from an indoor air quality perspective and to help facilitate higher levels of recycling. Different systems and timelines for residential, commercial and events (potentially tighter in the latter) should be considered, taking into account sector-specific challenges.

2.2.8 Treatment

The Member State should ensure that the organisations charged with the collection/take-back should ensure proper traceability and treatment, within the EU, in accordance with agreed national standards (to be developed) so as to avoid bogus recovery.

2.2.9 Modulated Fees

Fees for producers under collective schemes should cover the full costs of separate collection and treatment of carpets to meet the targets and necessary treatment standards. It should be noted that the clean-up costs associated with fly-tipping of carpets should also be covered by the EPR scheme where possible.

The costs of the actual collection and treatment incurred would be charged back by the PRO to registered producers based on their market share, factored according to an eco-design modulation factor. No charges would be made for carpet where the producer provides a take-back system and ensures / evidences proper treatment – i.e. taking the individual producer responsibility route and fulfilling the same reuse and recycling rates as are set for the sector as a whole.

A bonus-malus system should be applied based on the technical characteristics of the carpet which allow or inhibit circularity – i.e. a design for sustainability (DfS) modulated fee. It should be noted that the modulated fee approach is recommended to complement the mandatory ‘essential requirements’ noted above to offer an incentive to go beyond these minimum requirements (i.e. to drive innovation and faster progress) or as an alternative to offer a weaker incentive to drive better design. Removal of hazardous substances would always be part of the mandatory ‘Essential Requirements’.

The DfS fee would be calculated based upon a scorecard that takes into account various factors over and above the ‘essential requirements’, for example as shown in Box 4.

Box 4: Suggested Modulated Fee Criteria

The proposed scores are shown as a %.

- Elimination of all Sin-List chemicals. Yes or No – 100% or 0% ²²
- Number of years extended warranty offered by the producer – over and above the 5 year minimum ER level and as a percentage of 25 years as a maximum (hence a 10 year warranty is 5 years extra out of a potential 20 years extra)
- Percentage of post-consumer recycled content²³ (mechanical or chemical) in polymer fibres, and organic fibres in natural materials, over and above the minimum ER level up to 100%.
- Recyclability / reuse factors:
- Carpet type – broadloom (which is more difficult to reuse/recycle than tile designed for reuse and recycling) 0%, and tile without a PVC or bitumen backing, 100%
- Percentage of overall carpet material weight that is readily recyclable back into the same material with no down-cycling, over and above the minimum ER % and up to 100%
- Single polymer fibre use throughout (face fibre, primary and secondary backing), score 100%
- Design for disassembly to simply release at least 90% of the face and primary backing fibres by weight – for example the use of reversible hot-melt adhesives rather than latex. Yes or No – 100% or 0%

Each of the criteria would be weighted evenly. An example is given in Table 2-2.

²² Should the Essential Requirements ban on SVHCs be softened to less than 100% eradication, this criteria could potentially be adjusted, or a similar additional criteria be added to reflect this, e.g. 100% for eliminating all SVHCs and a further 100% for eliminating remaining Sin List chemicals.

²³ Conditions are necessary here in regard to the quality of the material used, in terms of the elimination of hazardous substances as defined above and in respect of not using mixed polymer/fibre types. Intentionally there is no call for a higher share of carpets produced from “renewable” bio-materials like PTT. Products made from such materials will add to the complexity in the sorting and recycling processes and will not guarantee greater circularity or lower overall life cycle impact.

Table 2-2: Modulated Fee Scheme – Criteria Scoring Example

Criteria	Specification	Score (out of 100)
Elimination of all Sin-List Chemicals	Yes	100
Warranty (years)	10	25 (5 years extra out of 20)
% PCR Content	20% (minimum)	0
Type	Broadloom	0
Material Recyclability	70% (minimum)	0
Single Polymer	Yes	100
Design for Disassembly	No	0
Score		225 out of a maximum 700
% Score		32% (100 x 225/700)
Modulated Fee factor (%)		68% (100% - 32%)

Carpets intended (designed and marketed) for single and short-lived use e.g. at events as opposed to long term use in a conventional sense, would be considered as zero years of warranty.

The Modulated Fee Factor would be used to adjust the fees paid to the PRO, i.e. those with a low score would pay more than one with a high score, in proportion with that score. The exact degree to which this variable element would apply is debatable but would need to be substantial to really incentivise good practice.

The French EPR system for furniture shows an example of a system in place that already uses a modulated fee, as described in Box 5.

Box 5: Case Study - EPR for Furniture in France

In France, end-of-life furniture is managed in line with EPR regulation. Separate schemes are in place for domestic and commercial furniture, managed and operated by Eco-Mobilier and Valdelia, respectively. The main objectives of the French EPR include:

- Decreasing waste furniture sent to landfill;
- Achieving a 45% recycling/reuse target; and
- Driving eco-design principles within the furniture manufacturing sector.

€80M was collected via levies in 2013 to finance the domestic scheme, paid by furniture producers, retailers and importers, to cover the cost of collection, logistics, infrastructure and R&D into new markets for recovered materials. In 2015, the domestic EPR scheme collected 0.85M tonnes of domestic furniture, achieving a 55% recycling and 86% recovery rate.

Under the French EPR scheme, 2016 saw the creation of Eco Modulation Criteria for new furniture placed on the market. A lower levy is charged to manufacturers, where they met environmental product criteria. This is essentially a simple criteria, in order for the process to be 'controllable'/not over burdensome to administer. This covers products which are:

- Manufactured 95% of metal, no padding, (easy to recycle)
- Manufactured from 95% made of wood, sourced from sustainable forests (easy to recycle)
- Products designed for babies / children which can be adapted to the growth of their user – e.g. furniture for children (cots which convert to beds/chairs, designed for growth)

Eco-modulation criteria had to be designed so that minimum 3% furniture could be eco-modulated by 2017. If companies comply with criteria, they pay a lower levy – a fee reduction of about 20% in order to incentivise design for recycling.

2.3 Supply-Side Supporting Measures

While EPR and the associated measures noted above would be the clear preference due to their potential to transform the market by generating upscaling of eco-design and recycling, the following measures could be employed as alternative or supporting measures.

2.3.1 Mandatory segregation of carpets

Many carpets end up in mixed waste streams, get contaminated and thus are lost for reuse and recycling. Mandatory segregation of carpets during refurbishment and demolition of buildings (commercial and possibly domestic) could be required, possibly through Green demolition/renovation certification or Site Waste Management Plans (as per UK) integrating carpet segregation requirements. This could fit with wider requirements for partial deconstruction of buildings in general and the concept of "material building passes", as in Austria, in which all recyclable materials and their specific position in buildings is noted to aid segregation and recycling.

2.3.2 Deposit Refund Schemes

Deposit return schemes (DRS) should be used to promote the high collection of short-lived carpets designed for use at events and carpet tiles so that reuse (which is more likely to result with tiles than broadloom carpet) is maximised as well as recycling. Research in the Netherlands of the impacts of a DRS for carpet, concluded that pricing of the deposit needed to encourage return but not be so high as to prevent re-use/re-sale.²⁴

Rather than making DRS mandatory at the outset, it could be used as an option if return rates don't meet expectations. It is worth noting that a redemption payment is far easier to arrange for a tile than a regular broadloom carpet as it can be done on a m² or unit basis quite easily. Regular broadloom carpet would be more difficult than tiles as the carpet could potentially be rolled up or even cut into pieces making a weight-based approach necessary. This is probably impractical given that carpet is sold by the m².

Another option here could be a modulated 'bulky waste' collection charge at the municipality level, free where the carpet is deemed reusable.

2.3.3 Product Passports

It is recommended that mandatory product passport information has to be provided on carpets for PROs and recyclers by 2022 – including the name and contact details for the manufacturer, year of manufacture, place of manufacture, full disclosure on the carpet composition (i.e. face fibres, primary and secondary backing/cushioning materials and construction, including adhesives etc.) and all chemicals used.

This could be attached as a physical label with a QR code, printed at regular intervals (back stamping) or firmly attached to the carpet at the time of fitting, however this may presents difficulties because it can get damaged over time and can be forged, leaving room for counterfeits which can contaminate the material loop with hazardous substances.

Therefore a digital information system, such as RFID+Blockchain is recommended as this more secure in the sense that it is very difficult to corrupt and provides a greater guarantee the carpet genuinely corresponds to the information logged in the material passport. Digital information can also allow automated information access and allow integration into any buildings information set.

2.3.4 Landfill Bans and Energy from Waste Restrictions

A simpler than EPR and DRS, if less direct, would be to restrict the disposal options in a Member State. A landfill ban alone could simply result in more incineration and hence would need to be linked to progressive EfW and cement kiln restrictions so as to

²⁴ <https://research.vu.nl/ws/files/2615950/R09-01.pdf>

encourage reuse and recycling. There is also a good case for an incineration tax to reflect the environmental externalities.

An export ban outside of the EU would also be desirable, although the cost of transporting bulky waste would help to make export over any significant distance unattractive in any case. A more significant problem could be additional fly-tipping and export within the EU for EfW; which would be difficult to restrict in terms of the single market.

2.3.5 Product Taxes to Cover Waste Management Costs

Where an EPR system is not deemed possible by a Member State in the short term, taxes on new products (alongside the incineration tax noted above) could be used as an alternative to producer fees so as to cover the costs of free collection and proper treatment to meet recycling targets. Otherwise these costs will fall on the state (municipalities or national government) and citizens rather than consumers of carpets.

2.4 Demand-Side Supporting Measures

2.4.1 Green Carpet Mark

Green product mark schemes, such as the EU Energy Consumption Labelling Scheme and Energy Star in the US for electrical and electronic equipment, BREEAM and LEED for buildings, have demonstrated value in enabling consumers (both private citizens and businesses) to select products based on environmental performance, whilst at the same time, encouraging suppliers to invest in more environmentally responsible product design. UK research²⁵ has shown that 80% of customers want independent product information and consistently express a willingness to pay more for a more durable product. In private and public sector procurement the problem often lies in a lack of available and verifiable information for the professional buyers and labels are one way of either providing information in a simplified form (e.g. EU Energy Label) or by-passing this by just asking consumers to trust the eco-label 'brand'.

A Green Carpet Mark (GCM) could be devised to build on the existing GUT-PRODIS label and could complement rather than replace a pass-fail national or EU Type 1 Eco-label (see below). While GUT-PRODIS falls short in terms of not covering all toxics and not being focused on circular economy factors, it is already widely used by manufacturers and contains some of the basic information required for the GCM. It would be desirable for the GCM to use the same set of core criteria used for the 'essential requirements' and modulated fees – i.e. a combination as shown in Box 6 below, and that would also be applied to national GPP and eco-label criteria.

The intention here is that the GCM would have an A to G rating (as per the EU Energy Label) to provide private consumers and procurement professionals with clearer

²⁵ WRAP, Switched on to Value report and the 2017 update

information on the environmental and circularity performance and features of the carpets. This would be determined by a points style system (similar to the BREEAM approach for buildings) by using a self-assessment approach but with oversight and verification by an independent third party.

The criteria would mirror the modulated fee criteria as shown in Box 6 and would be scored in the same way. The highest rating, Class A, of the GCM would correspond to what is also required by the more comprehensive national and EU-wide ecolabel schemes. The minimum essential requirements level, where mandated, would correspond to the lowest G rating (i.e. compliance).

Box 6: Suggested Eco-Design Factors for the GCM (over and above the ERs)

- Elimination of all Sin-List chemicals. Yes or No – 100% or 0%²⁶
- Number of years extended warranty offered by the producer – over and above the 5 year minimum ER level and as a percentage of 25 years as a maximum (hence a 10 year warranty is 5 years extra out of a potential 20 years extra)
- Percentage of post-consumer recycled content²⁷ (mechanical or chemical) in polymer fibres, and organic fibres in natural materials, over and above the minimum ER level up to 100%.
- Recyclability / reuse factors:
- Carpet type – broadloom (which is more difficult to reuse/recycle than tile designed for reuse and recycling) 0%, and tile without a PVC or bitumen backing, 100%
- Percentage of overall carpet material weight that is readily recyclable back into the same material with no down-cycling, over and above the minimum ER % and up to 100%
- Single polymer fibre use throughout (face fibre, primary and secondary backing), score 100%
- Design for disassembly to simply release at least 90% of the face and primary backing fibres by weight – for example the use of reversible hot-melt adhesives rather than latex. Yes or No – 100% or 0%

The US Cradle to Cradle Certified™ Product Standard takes a similar approach but just uses five quality categories to determine an overall score — material health (related to the presence of hazardous substances), material reutilization, renewable energy and

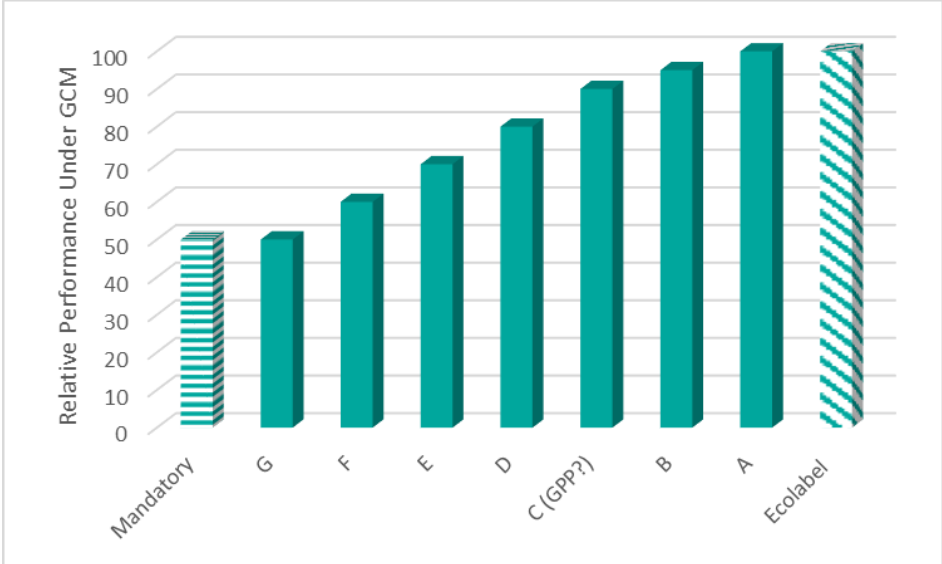
²⁶ Should the Essential Requirements ban on SVHCs be softened to less than 100% eradication, this criteria could potentially be adjusted, or a similar additional criteria be added to reflect this, e.g. 100% for eliminating all SVHCs and a further 100% for eliminating remaining Sin List chemicals.

²⁷ Conditions are necessary here in regard to the quality of the material used, in terms of the elimination of hazardous substances as defined above and in respect of not using mixed polymer/fibre types. Intentionally there is no call for a higher share of carpets produced from “renewable” bio-materials like PTT. Products made from such materials will add to the complexity in the sorting and recycling processes and will not guarantee greater circularity or lower overall life cycle impact.

carbon management, water stewardship, and social fairness. A product receives an achievement level in each category, Basic, Bronze, Silver, Gold, or Platinum, with the lowest achievement level representing the product’s overall mark. This 5 category approach, as opposed to a 7 category A to G ranking, could also be used for the GCM to simplify the labelling if required.²⁸

Ideally the deployment of such a GCM would be mandatory, requiring all carpets to be assessed and labelled under the GCM scheme, although a voluntary approach would also be possible, for example with take up by manufacturers being driven by GPP. The GCM could also be used to complement both minimum eco-design standards and EPR, just as the EU Energy Label complements Eco-design minimum standards and EPR for EEE products. It is worth noting that the Energy Label is already used to reflect additional performance information, notably in the vacuum cleaner label which includes information on noise, dust emissions and cleaning performance as well as energy use. Tyres also have additional performance information presented.

Figure 2-1: The Relationship between GCM, GPP and Ecolabel



In the future it may be possible to use the LCA based Product Environmental Footprint (PEF) information as an alternative or complement to the GCM, assuming this approach is adopted for floor coverings at the EU level. It should be noted that LCA outcomes are very much influenced by the assumptions and boundary conditions set. Issues such as littering are generally not included.

²⁸ It is worth noting that the C2C certification itself has not been considered for direct adoption here as it is a private label and not entirely transparent, with the costs being paid for by producers. In addition, only with the highest C2C Platinum certification does the producer promise to take back and re-use/recycle its product.

2.4.2 National Eco-Labels

Unlike the GCM noted above, which would be mandatory and on a graduated scale, nationally-defined and certified eco-labels are binary (i.e. there is a need to meet all criteria to obtain the label) and voluntary and offer companies the chance to have lower-impact products certified by a third party and labelled as 'green' products with the associated logo. It is worth noting that there is no longer an EU Ecolabel for carpet or floor covering and hence there is a gap where individual Member States have no national or regional label.

The labels that do exist, including Gut-Prodix, Blue Angel, Nordic Swan and the US Carpet and Rug Institute Green Label Plus, have a hazardous substances and indoor air pollution focus, but could be expanded to include all of the core criteria used as the basis for the modulated fee and GCM. Note that some of these are industry-led labels and we would recommend the use of independently verified Type I eco-labels under ISO14024 rather than Type II labels which, being environmental self-declarations, are harder to validate.

The existence of a graduated GCM label, as described above, would partially negate the benefit of a separate certified eco-label, although this would reflect a clear gold-standard (the top 10% to 20% of the market in LCA terms) as depicted in Figure 2-1.

2.4.3 Green Public Procurement

GPP offers significant potential to drive demand for products and CE business models with better environmental performance. The voluntary uptake of GPP limits its potential to impact on the sector, with a need for more binding objectives to ensure a more widespread adoption across the public sector. Overall, the level of EU GPP uptake in the EU28 appears far lower than the 50% target set by the European Commission in 2008.

GPP for carpets should therefore be made mandatory, as is the case for GPP in general in Italy. Flanders has also set a target of 100% SPP (Sustainable Public Procurement; essentially GPP) by 2020, but only for products for which sustainable product criteria are available. No such criteria have been defined for carpets as yet. Other mandatory public procurement requirements include Wales in the UK where there is a general requirement to take sustainability into account under the Well-Being of Future Generations Act.

Any national (or EU) requirements for carpet could also be based on the same core criteria set as described for the modulated fee above, and additionally requiring 'no-adhesive installation'. Carpet tile leasing should also be made the default option, with a case having to be made not to do so and in the context of whole-life-costing. GPP requirements could be linked to the GCM directly (or to a national eco-label), offering procurement professionals a simple means to specify 'green' carpet; e.g. requiring a minimum of a B rating for example on a scale of A to G.

An example of a similar application can be found in the US. In March, the City & County of San Francisco adopted a comprehensive new regulation requiring that all carpet installed in city-funded construction projects be Cradle to Cradle Certified™ Silver (i.e. mid-scale below Gold and Platinum) or better the aim being to help San Francisco

address its priorities for sustainability and material health in its flooring. The resulting regulation also limits flooring purchases to carpet tiles given that they are easily replaceable and help minimise waste.²⁹

In addition to C2C certification, carpet tiles must also have a CRI Green Label Plus certification, an Environmental Product Declaration[®], and a compliant Health Product Declaration at 1,000 ppm or a Living Building Challenge™ Declare label. Furthermore, products must not contain intentionally added antimicrobials, flame retardant chemicals, or highly fluorinated compounds. At this time, only a small number of brands (Shaw Contract, Patcraft and Tandus), have products available that meet the requirements. Similar rigour was used to determine the minimum requirements for the adhesives used.

2.4.4 Tax Incentives and Subsidies

Lower rates of VAT for carpets that meet well-defined eco-design requirements could be considered, and there is some discretion given to Member States under the VAT Directive to apply reduced rates of VAT to supplies of goods or services, but in particular to local, labour intensive services. So far there are few practical examples, the most well-known being the Swedish reduced VAT rate for repair services (note, a local service, not a product).

Fixed amount subsidies for eco-friendly products may be simpler to deploy than reduced rates of VAT, since whilst a subsidy scheme can be administratively cumbersome, direct fiscal incentives belong to the sole competence of the EU Member States and hence should not be challenged by the EU.³⁰

Because of the hazards associated with PVC, Denmark had imposed an additional tax for products containing PVC in order to reduce phthalate use as well as to reduce PVC in landfill and incineration operations. However, in November 2017 Denmark announced that it is lifting the tax on PVC containing products because the tax is no longer considered to have any ‘significant behavioural effect on health or the environment’ and so will end 1 January 2019. It is also useful to note that any EU-wide tax on virgin plastic use could be very effective in making the use of recycled content more attractive, especially given the relatively high density and weight of carpets.

The use of taxes or subsidies may not in any case be necessary where mandatory requirements on eco-design can be put in place or where GPP and modulated EPR fees can sufficiently drive the market.

²⁹ <https://www.c2ccertified.org/news/article/new-san-francisco-regulation-requires-cradle-to-cradle-certified-silver-or>

³⁰ DG Taxation and Customs Union (TAXUD) (2009) Working Paper No.19, The Role of Fiscal Instruments in Environmental Policy

2.5 Other Measures

2.5.1 Infrastructure Support

The infrastructure required to meet the expected increase in carpet recycling needs to be developed across Europe, including collection and treatment facilities, and this will be costly. The capital cost of this infrastructure (as well as the actual operational costs of collection and recycling) can be recouped through EPR Fees, unclaimed Deposits (where applied) or additional Taxes (e.g. on new carpets or incineration for example). Additional national funding may also be necessary in the way of grants and low interest loans from governments and green investors to support the infrastructure development in advance of the EPR scheme operation. Having EU wide direction in the form of targets and other requirements would be an effective way to provide the certainty for investments given the predictable supply of carpets that would follow.

2.5.2 Innovation Support

A wide range of innovation and investment in both carpet design and manufacture will be required to meet the objectives of a truly circular carpet sector and respond to the eco-design incentives noted above. National and EU wide innovation support and grant/low-interest loan schemes, such as those provided through Innovate UK, Zero Waste Scotland (Circular Economy Investment Fund) and Horizon 2020 can all play a helpful role in accelerating change. Ideally national innovation funds can be supported by EPR fees. This innovation support could be combined with other business tax incentives for CE carpet companies.

2.5.3 Consumer Guidance

Clear national guidance for private consumers and businesses would be helpful in order to raise awareness of the need to reuse and recycle carpet where possible and the means available locally to do that. It would also be helpful to run national campaigns to raise awareness of the GCM and how it works and of the relationship to any national eco-label.

3.0 Summary Recommendations

A wide variety of policy instruments are set out in the previous sections with discussion as to how they might be applied. Clearly Member States will vary in what they feel able to implement in the short to medium term and hence the Toolkit offers options. As new EU legislation on circular economy enters into force, EU countries will need new strategies to meet their targets and carpet waste stream might present an avoidable waste stream with great potential to incentivise innovation and create local jobs. The following table suggests some potential combinations, on the supply side (waste management and market 'push') and the demand side (market 'pull'), that might be used together, varying depending on the level of ambition that member states want to achieve on this

particular waste stream. By adopting ambitious approaches, carpet can also become a sector where circularity becomes reality and a model for other sectors.

Two policy packages are suggested by way of showing how policy instruments could be combined. Package 1 provides a fully mandatory EPR-led approach, designed to meet the needs of Member States with the highest Circular Economy (CE) ambitions. EPR is used here not only as a vehicle to deliver and pay for high levels of recycling, but also to provide a meaningful incentive for better design through modulated fees, working to supplement minimum eco-design 'essential requirements'. Other instruments are suggested to help drive demand, including a Green Carpet Mark to provide clear consumer information and mandatory Green Public Procurement.

Package 2 is suggested as an alternative to, or precursor to, Package 1 where an EPR approach is not immediately possible, using additional 'essential requirements' rather than modulated EPR fees to drive eco-design and mandatory take back and taxes being used to respectively facilitate and pay for the waste management aspects. The demand side instruments remain as for Package 1.

Package 1: Fully Mandatory with EPR

Mandatory eco-design measures – minimum 'essential requirements' (ERs) to:

- Phase out all hazardous materials/substances
- Provide a minimum five year warranty
- **Set minimum recycled / organic content levels** ³¹
- **Set minimum recyclability requirements** ³¹
- Provide 'product passports' to assist recyclers, collectors etc.
- Mandate installation techniques that allow easy removal

Mandatory Extended Producer Responsibility (EPR) with:

- Mandatory and progressive 'preparing for reuse' and recycling targets, with producers covering the full costs of collections for consumers and proper treatment.³²
- Modulated producer fees, to reward eco-design going beyond the minimum 'essential requirements', and penalise sub-optimally designed products, to reflect negative health and environmental impacts.
- Support initiatives for CE innovation in the sector, combined with tax breaks, grants and/or low interest loans for CE carpet manufacturers and carpet recycling companies.

Mandatory Green Carpet Mark (GCM) grading and labelling to give full transparency on eco-design features to help inform purchasers (public and private) with an A to G rating (G =

³¹ Note that these two ERs could potentially be dropped where the EPR modulated fee and recycling targets in combination are deemed sufficient to drive change

³² Note that 'preparing for reuse' is the legal term used for sorting and refurbishment to allow reuse whereas direct reuse is where the item never becomes waste and is simply passed on with that intention.

mandatory to meet the ‘essential requirements’ minimum) or similar (e.g. bronze, silver, gold).

Mandatory Green Public Procurement (GPP) linked to the GCM to drive demand for more sustainable carpets with common criteria and minimum GCM level required (e.g. C or B rating).

Consumer information campaigns to support separate collection and understanding of the GCM.

Package 2: Part Mandatory – Without EPR but With Incentivised Collection

Mandatory eco-design measures – minimum ‘essential requirements’ to:

- Phase out all hazardous materials/substances
- Provide a minimum five year warranty
- Set minimum recycled content / organic content levels
- Set minimum recyclability requirements
- Provide ‘product passports’ to assist recyclers, collectors etc.
- Mandate installation techniques that allow easy removal

Mandatory take back, or a Deposit Refund Scheme (DRS), for carpet tiles and events carpets to encourage return for reuse and recycling, combined with free ‘bulky waste’ collection at the municipal level for residential carpet where it is deemed reusable or recyclable.

Progressive national targets³³ for ‘preparing for reuse’ and recycling, with taxes on new carpet (and possible incineration) to cover the costs of collection and treatment.

Support initiative for CE innovation in the sector, combined with tax breaks, grants and/or low interest loans for CE carpet manufacturers and carpet recycling companies.

Mandatory use of the Green Carpet Mark (GCM) grading and labelling to help inform purchasers (public and private) with an A to G rating (G = mandatory to meet the ‘essential requirements’ minimum) or similar (e.g. bronze, silver, gold).

Voluntary GPP, but with reference to a minimum standard under GCM (e.g. C or B rated).

Consumer information campaigns to support separate collection and understanding of the GCM.

These are only suggested combinations to illustrate the way that policy instruments could be used together in order to overcome certain market barriers that currently exist to fully circular products. Others combinations can of course be conceived to suit particular Member State preferences. In addition, many of these measures could also be designed and implemented at the EU level to achieve the highest possible benefits across the internal market.

³³ Note these are not the producers responsibility – hence the absolute need for recyclability requirements to be added to the ERs

As noted earlier, it would be desirable for the GCM to use the same set of core criteria used for the national 'essential requirements', the EPR modulated fee structure, GPP, and where they exist, the national eco-label. In any case consistency should be promoted, e.g. by which the highest rating of the GCM (e.g. an A rating) corresponds to what is also required by the more comprehensive national ecolabel scheme and the lowest (e.g. a G rating) to the minimum 'essential requirements' level.

APPENDICES

A.1.0 Current Carpet Circularity Issues

A.1.1 The EU and US Carpet Markets

The EU is the second biggest market in the world for carpet after the US, as well as being one of the largest producers: Belgium, the Netherlands, and the United Kingdom are the EU's leading manufacturing countries. Overall around 65% of EU demand for carpets is fulfilled by EU-based manufacturing, which is high compared to other textile products. Additionally, 17 % of EU production is exported, with the US being the most popular destination³⁴. The United States imported carpet valued at \$600 million from Europe in 2016, mainly from Turkey (valued at \$267M) and Belgium (\$95M). The demand for carpets in the EU amounts to almost 1.8 million tonnes (Mt) per year, while around 1.6 Mt arises per year as waste, suggesting that there is a slight growth in the overall carpet stock in the EU.

Carpets come in a wide range of different types. Roughly these product types can be split into 3 main groups: loose laid rugs, wall-to-wall floor coverings (residential and commercial, including events) and non-flooring applications (e.g. automotive, outdoor sport fields and landscaping). The study focus is on the second one of these, which represents textile floor coverings. The industry sector in the EU is represented by ECRA (European Carpet and Rug Association) covers approximately 90% of EU's textile floor coverings production. The type of the carpet (e.g. woollen carpet, nylon carpet, polypropylene (PP) carpet or polyester (PET) carpet) is generally defined by the carpets face fibre material and not by the materials used for the backing. Every type of face fibre has different quality characteristics and is hence used to satisfy different preferences or to meet different performance requirements (wear resistance, inflammability, softness; vehicles, hotel rooms, offices, living rooms etc.). Sometimes different fibres are mixed in order to create specific properties for the carpet.

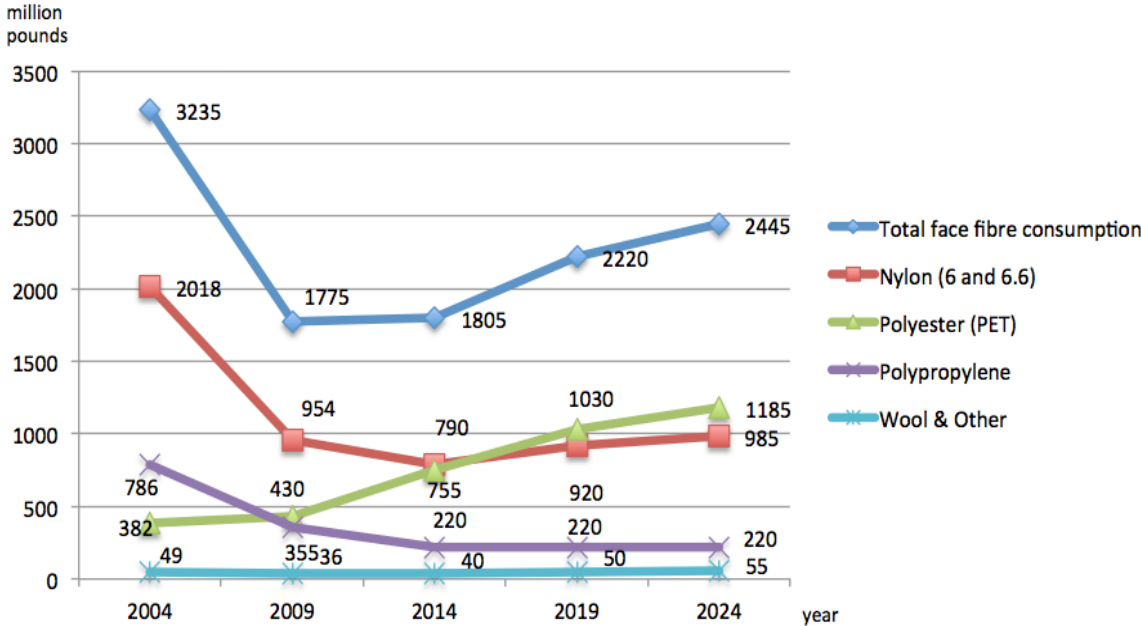
Carpets can be produced in various ways but primarily woven on a loom, 'tufted' through a primary backing or made using a needle felting (fibre entanglement) approach. In addition, they can be made in the form of broadloom (i.e. a wide carpet), carpet tiles and vehicle carpet (often moulded to shape). Most carpets are tufted (around 80%) and the share of carpet tiles is constantly on the rise (Checalier 2016). Tufted pile yarns can be made from wool, nylon, polyester or polypropylene and are usually made with a polypropylene primary backing and then locked in place using a synthetic rubber-based latex adhesive. Chalk is also added to the backing to provide

³⁴ Toxics in Carpets in the European Union, Anthesis, March 2018

weight and stability. In some cases it is thought that fly-ash has also been added as a filler material.³⁵

In the EU as the US, the fibres used are mainly polymer based, i.e. plastic. In the EU, the use-layers of the textile floorcoverings, depending on the field of application, consist of (79%) PP (polypropylene), PA-6 & PA-66 (i.e. two types of nylon) and to a minor part of PET (polytetethylene terephthalate). The remaining 21% are covered by wool, jute, cotton and other natural fibres. The demand on face fibre (for carpets and rugs) in the US is predicted to develop as shown in Figure A-1-1Error! Reference source not found..

Figure A-3-1: Development of US face fibre demand for carpets and rugs from 2004-2024 (The Freedonia Group, Inc. 2015b)



Nylon carpet fibres, while less expensive than wool, are the most expensive fibres compared to other artificial fibres like polypropylene (PP – more widely used in the EU) and polyester (PET – widely used in the US). In comparison to polyester (PET) fibres, nylon can be three times as costly. Nylon is durable and can easily withstand wear and tear and although hygroscopic it is less absorbent than wool. Nylon fibres can be dyed after production in almost any colour. These preferable characteristics, however, still make it a well-used fibre despite the cost. In the US it accounted for 43.8% of the fibre consumption in 2014, followed by PET fibres (41.8%) (The Freedonia Group, Inc. 2015b).

³⁵ In the US at least - <https://healthybuilding.net/uploads/files/eliminating-toxics-in-carpet-lessons-for-the-future-of-recycling.pdf>

The majority of polyester carpet face fibres are made from PET, which are the second most used fibre in the US and will soon overtake the share of nylon. This is more true for the US than for Europe (Vankann 2016). Because PET face fibre is mostly made from recycled bottles, PET carpets are seen as environmentally friendly, although it is not clear if it is better or worse from an LCA perspective to recycle bottle to bottle rather than bottle to carpet. The latter could be regarded as downcycling. In the US it is expected that PET fibres will continue to be less expensive than PP fibres whilst offering good performance and aesthetic properties, leading to a further decrease of the PP market share in the US (The Freedonia Group, Inc. 2015b). The EU market, however, remains dominated by PP and nylon use.³⁶

Polyester carpet fibres can also be formulated from polytrimethylene terephthalate (PTT). These fibres are often presented as environmentally friendly materials, as they contain plant-based material and are suggested as having a lower carbon footprint, although this is sometimes disputed depending on what is taken into account. Dow Sorona® EP contains 20% to 37% renewable material from non-food biomass, and has performance similar to conventional PBT plastics according to Dow. PTT fibres are generally also stain resistant and have consistent colourfastness properties. However, PTT fibres can cause problems in recycling systems set up to deal with mainstream polymers and hence are likely to be down-cycled (The Freedonia Group, Inc. 2015b). Caprolactam, which is used as a monomer in PA6 (nylon), can also be produced from biomass.³⁷

The residential carpet market accounts for around 55% in the EU, with non-residential buildings account for 39% and transport (trains, planes, ships, cars etc.) account for around 6%³⁸. Broadloom continues to be the most popular carpet form, although there are indications that the carpet tile market will continue to gain market share, particularly for commercial applications. In the UK, the carpet tiles market represent only 10% of the overall carpet market. However, in the commercial area in the UK they represent nearly 50% of the market. Carpet is 73% of the UK flooring sector (market size per annum: 210 million m², waste volumes per annum: 414,000 tonnes)³⁹, hence approximately 20 million m² of carpet tile is sold annually in the UK, with significant reuse potential at the end of their first life. In 2014, over 1.2 million carpet tiles or 330,000 m² was collected in the UK for reuse, recycling or energy recovery.⁴⁰ The reuse of carpet tiles has increased by 8% between 2014 and 2015 (ibid.)

³⁶ Carpet Recycling UK Conference 2016

³⁷ <http://www.chemengonline.com/bio-based-caprolactam-joint-development-project-now-underway/?printmode=1>

³⁸ Detoxing Carpets; EPHA/HEAL – Based on Anthesis Study, Toxics in carpet in the EU, March 2018

³⁹ http://www.wrap.org.uk/sites/files/wrap/Flooring_REAP.pdf

⁴⁰ http://www.carpetrecyclinguk.com/newsletter/carpet_recycling_uk_february_newsletter_2015.html

A.1.2 Current Carpet Recycling

While there is some very good practice (e.g. Interface recycles calcium carbonate from tile to tile and backing back into backing) overall there is only a small percentage of post-consumer carpet recycling happening in the EU and US and the amounts that do get recycled are mostly getting down-cycled (all backings, and all face fibres other than nylon 6). Overall EU carpet recycling levels (excluding any energy from waste) are estimated to be around 3%.⁴¹

The vast majority of carpets are currently made from oil-based plastic materials which are often mixed and bound by latex in the backing, making recycling very difficult. Only nylon 6 (and possibly 6,6) are recycled back to carpet fibres at present due to the relatively high cost of new nylon. The relatively low cost of virgin and good quality recycled PP and PET makes very capital intensive processing of PP and PET carpets economically unfeasible. Design can therefore play a crucial role in making carpets more readily recyclable at a lower cost.

A.1.3 Main Recycling Processes

A.1.3.1 Mechanical Recycling

Mechanical recycling includes a range of techniques including dry systems that essentially aim to shred and hammer materials to separate fibres from the adhesives and release filler materials. This results in low grade mixed material for equestrian surfaces, carpet underlay and secondary backing etc. Dry/wet systems start with a dry stage (as described above) and then have a wet stage to help to separate different polymers to high levels of purity (95% pure nylon face fibre from PP backing is reported for example). This is still a capital intensive solution although one employed in the US and possibly the EU. It seems that Northcoast Fibres in the US are working on more affordable means for recycling PET and PP carpets, although the technology is not known at present. The recovered polymer fibres can then be processed further by plastics reprocessors who will wash and extrude to made new plastic pellets and yarn.

In terms of carpet tiles, bitumen backing, as still used in some cases, creates specific problems for recycling as the bitumen melts during reprocessing. However bespoke recovery processes by carpet tile manufacturers, such as Desso Refinity[®], have been developed to recover nylon pile yarns as well as the bitumen content.

⁴¹ Detoxing Carpets; EPHA/HEAL – Based on Anthesis Study, Toxics in carpet in the EU, March 2018

A.1.3.2 Shearing Systems

Shearing systems cut the face fibre off the backing material in a machine. The purity of the material is consequently very high (around 99%) where there is only one face fibre being used. The equipment is relatively cheap and unsophisticated and can be deployed locally. The down side is that the material yield is only 30% to 40% by weight, leaving the backing material as a carcass that can only be used for down-cycling or landfill. Much of this weight is actually chalk filler (calcium carbonate) and latex.

A.1.3.3 Chemical Depolymerisation

Depolymerisation (chemical recycling) is used for the general decomposition of mixed used plastics and is used for the depolymerisation of nylon 6 carpet to allow new nylon 6 to be made from the resulting pure monomers, as in virgin nylon processing. This approach is very capital intensive and uses large amounts of energy and chemicals and of course results in some residues, but produces pure nylon 6 that has a relatively high value compared to other processing techniques. The Aquafil plant in Slovenia is now perhaps the largest global facility (the US Evergreen site in Augusta having closed) and cost €25m in 2011.

A.1.3.4 Chemical Washing

It is important to also note the potential of chemical cleaning as a stage before chemical recycling. In the food industry, the cleaning with critical CO₂ has been well established (over 80 yrs) and ING-PUM (www.ing-pum.de) holds a patent in the same technique for synthetic polymers. This method can handle mixtures (i.e. 96% PA6 + 3% PA 6.6. + 1% unknown) and can remove additives and even colour (pigment). Ioniqa (<http://www.ioniqa.com/>) applies a different method (ion-exchange) to clean PET (they can only process PET at this point).

From an energy efficiency point of view, it may be helpful to clean polymer streams and resell them at this point rather than breaking them down to the monomer level and subsequently putting them back together as a polymer. ING-PUM is already operational, as is Ioniqa, though not yet applied to harvest secondary raw material from end-of-life carpets. A current Horizon2020 project is scaling an industrial pilot for the chemical recycling of PET (see <https://www.demeto.eu/project>).

A.1.3.5 Dyeing

It is worth noting also that PP fibres must be dyed during fibre production (when the polymer is still in its molten state) unlike nylon fibres, which can be dyed after fibre production. Similarly recycled PET is also not free of colour and PET face fibre carpets cannot be printed on. The fibre, therefore, needs to be coloured prior to the carpet production. Compared to Nylon, which can be recoloured quite easily, recycled PP and

PET fibres cannot and, since colour sorting of fibres is technically challenging, are less useable as mixed colour fibres.

A.1.4 Current Collection and Recycling

As noted earlier, overall EU carpet recycling levels (excluding any energy from waste) is estimated to be around 3%,⁴² i.e. lower than the UK on average. Carpet Recycling UK (CRUK)⁴³ claim that the UK in 2015 diverted 31% of carpet waste (~125,000t out of ~400,000t), although of this 31%, energy recovery is 65% and recycling is 35% (~11% recycling in absolute terms) – the total 35% breaking down as 28% going into equestrian surfaces and carpet underlay/mattress pads (i.e. both downcycling) with only 1% as tile reuse, 4% plastics recovery and 3% [other] fibre recovery.

Some of the recycling already includes pre-consumer off cuts from fitting and end-of roll carpet which are relatively clean, however post-consumer carpets are bulky, heavy and often dirty and hence difficult for consumers and contractors (who deal with most residential and commercial carpet fitting) to handle. It is worth noting that carpet tiles can also be difficult to recycle as they can be stuck to the floor (other options re available) or have a bitumen or glass fibre reinforced backing to enhance dimensional stability (important for a carpet tile) and durability. Carpet tiles, however, offer a wide range of reuse possibilities. It is also worth noting that event carpets could also be reused but are currently treated as single use disposable items by most in the industry with a few exceptions (see Reed Carpets example below where the carpet is recycled).

There are very few dedicated collection facilities or take back schemes (even in the commercial B2B sector, let alone B2C) and often the carpets get mixed with general waste and heavily soiled, i.e. wet and dirty. Tarkett (Desso) and Interface do some take-back, however even these circular economy leaders have not managed large scale collection and recycling - indicating the need for structural wide-scale solutions.

At present in the UK, for example, only 20% of local municipalities have segregated carpet collection at household waste recycling centres (HWRCs). In terms of commercial carpets, it is important that the carpet is removed before refurbishment begins in commercial buildings as refurbishment can result in the carpet being effectively destroyed by dirt, plaster and paint splashes.

ECRA claims that it is possible that one kg of carpet can contain up to 400g dust and dirt (ECRA 2016), which mostly occurs because the old carpet is often not removed until the end of a renovation. This does not only make it harder to identify the actual carpet fibre type but affects the feasibility of the necessary collection and transportation. During this

⁴² Detoxing Carpets; EPHA/HEAL – Based on Anthesis Study, Toxics in carpet in the EU, March 2018

⁴³ Recovering carpet resources – Industry update. Jane Gardner, Carpet Recycling UK Conference 2016

phase other contaminations with e.g. plastics, dirt or rain are very common, which affects the sorting and recycling phase.

Local authorities will also undertake bulky waste collections that include carpets in most instances, but not separate from other wastes. Separating carpets from general waste is not practical or economically viable in most cases due to high levels of contamination, hence excluding carpets from the recycling chain. Carpet composition work in Germany in 2009 (Vankann 2012, p. 39) showed that of the collected post-consumer carpet, around 42% was latex and chalk, 9% was dust, 20% PP material and only 13% nylon 6 and nylon 6.6.

Most collectors and recyclers in the US and Europe charge fees for taking carpets away and further processing them (sorting, cleaning, shipping etc.) (The Freedonia Group, Inc. 2015b). In the main this happens in the commercial B2B sector only, although CRUK also note that there is a significant increase in collection from retailers, taking back carpet waste from the retailer as a client service.⁴⁴

Recycling costs can be high. WRAP reported ⁴⁵ in March 2014 that UK gate fees ranged from around £130 to £150 per tonne for carpet tile re-use including collection costs and £50 to £100 per tonne for both recycling and energy from waste facilities (not differentiated by price in the report) for broadloom carpet and carpet tiles not suitable for re-use, excluding collection costs. Landfill costs are, however, also over £100 per tonne.

A.1.5 Barriers to Circularity

Several key barriers have been identified with regard to carpet circularity:

- Key area 1: A lack of design drivers to facilitate reuse, refurbishment or recycling of carpets. Simple single polymer and more readily-separated designs are necessary to keep recycling costs down and increase material yields. While some manufacturers do have recyclable designs, these products represent a small market share and concrete and enforceable product requirements are still lacking at the EU and national level.
- Key area 2: Economic barriers and uncertainty. Recovery of plastics, even in the down-cycling sense, from carpets is a complex process that can be very costly. Closed loop recycling requires very high levels of investment and yet the value of the resulting material may be less than the cost of the reprocessing, especially when the oil price is low. Clearly reflecting the environmental externalities in the price of virgin material would be helpful in this sense.

⁴⁴ CRUK Conference presentation 2016

⁴⁵ Guidance on re-use and recycling of used carpets and environmental considerations for specifying new carpet

- Key area 3: A lack of cost effective collection, sorting and reprocessing methods. Better methods are required that maintain product integrity (e.g. not being bonded to a floor), segregation, minimise contamination and maximise yield recovery at a reasonable operational cost.
- Key area 4: Traceability and toxicity. Carpets can contain a wide range of materials and legacy chemicals (potentially from decades ago) that would be prohibited under REACH in many products today. Not knowing what materials are present, for example in terms of fibre types and chemicals, limits the potential to recycle or even down-cycle the fibres and other materials.
- Key area 5: Lack of producer responsibility for carpets and resulting waste streams. An EPR system would mandate carpet recycling and drive better design to reduce toxicity and recycling costs.

A.1.6 Hazardous Substance Issues

The recent Anthesis report⁴⁶ for Changing Markets has identified a list of 59+ toxic substances used in carpets sold on the EU market. Healthy Building Network (HBN) has also identified similar issues in the US⁴⁷. The list of substances includes phthalates, perfluorinated compounds (PFASs), azo dyes, isocyanates, flame retardants, anti-microbials and toxic heavy metals. Based on the research, it appears that many of the chemicals found in carpets may volatilize and/or migrate from carpets through typical use and abrasion of carpet as well as adhere to dust – making dermal, inhalation, and ingestion exposure to their toxic effects all possible. Some of the toxic effects of the chemicals of concern identified in this report include carcinogenicity, mutagenicity, reproductive toxicity, and endocrine disruption just to name a few.

Moreover, children are particularly vulnerable to these toxic chemicals, particularly during critical stages in their physical and cognitive development. Of the 59 substances identified in the report, 37 are not restricted or banned for their use in carpet or carpet materials. Additionally, many of the certifications that monitor chemicals in carpets do not currently ban or restrict the chemicals of concern in this report either. For example, the GUT label only bans or restricts 13 out of the 59 identified chemicals of concern.

There are ‘hidden costs’ associated with the use and exposure to chemicals of identified in this report. Health care costs and lost earnings linked to the exposure to endocrine disruptors is estimated to be €163 billion each year in the EU⁴⁸. There are also hidden costs associated with environmental contamination such as necessary infrastructure for

⁴⁶ Toxics in Carpets in the European Union, Anthesis, March 2018

⁴⁷ Eliminating Toxics in Carpet: Lessons for the Future of Recycling. Healthy Buildings Network, October 2017

⁴⁸ Andrology. 2016 July ; 4(4): 565–572. doi:10.1111/andr.12178

Burden of disease and costs of exposure to endocrine disrupting chemicals in the European Union: an updated analysis

clean-up. Industry is therefore often not responsive to the true costs associated with toxic chemicals and/or the products they create and these costs typically are passed onto tax payers.

A.1.7 What Constitutes Good Eco-Design?

What can be considered 'good' eco-design is to a degree subjective with various trade-offs to consider in life cycle impact terms. The following sections, however, set out what can generally be regarded as good practice in most circumstances in terms of reducing overall environmental and health impacts. This understanding is important in terms of setting eco-design criteria and modulating EPR fees.

A.1.7.1 Sustainable materials and low toxicity

Low toxicity and use of sustainable/low-impact materials is an important part of eco-design and essentially includes consideration of:

- Zero known hazardous substances and substances of very high concern (SVHCs)
- Natural low-impact materials – e.g. wool, jute and sisal – where hazardous chemicals have not be used in treatments
- Recycled plastic content (where legacy toxins can be eliminated); and potentially
- Bio-based materials (although this is debatable – see below)

A.1.7.2 Hazardous substances

The hazardous substances remain of great concern as noted in Section 5, and the 59 chemicals of concern identified in the Anthesis report should be restricted and/or banned to ensure consumer safety, environmental protection and facilitate the circular economy. One approach would be to ban all SVHCs on the REACH Candidate List, or to move only to chemicals that are not on the more extensive SIN List: <http://chemsec.org/business-tool/sin-list/>. The SIN List has been devised by chemists to help speed up the process of identifying SVHCs before they are classified as such and placed on the Candidate List. Substitution of chemicals is a complex task and it would be helpful for member states to start driving the development of solutions ahead of EU legislation under REACH.

It is worth noting that nylon does not need an anti-stain coating, being inherently quite easy to clean, which may help reduce the use of chemicals overall. Plastic carpets also don't need moth-proofing. Conversely, wool is doesn't need a flame retardant (being naturally flame resistant) but does need stain protection and moth-proofing but to process wool (and remove grease) some chemical treatment are also used. There is therefore no simple answer in terms of which materials may be preferable in hazardous substance terms.

It is also worth noting that less hazardous flame retardants have already been developed and are in use. For example the Healthy Building Network report⁴⁹ notes that .. “Most of the carpet industry has successfully flame retarded their carpets with alumina trihydrate or other non-hazardous options.” Germany’s Blue Angel ecolabel for carpets identifies many low hazard options: “To the extent as required by fire protection regulations inorganic ammonium phosphates (diammonium phosphate, ammonium polyphosphate etc.), other dehydrating minerals (aluminium hydrate or the like) or expandable graphite may be used as flame retardants. Antimony oxides shall not be used as flame retardants.”

A.1.7.3 Recycled and bio-based materials

It is worth noting that several companies are already making use of recycled content (not necessarily closed loop, carpet to carpet), including Interface, Tarkett (Desso), Balta and other brands that use the Econyl recycled content from Aquafil. Desso, for example, produces the Refinity closed loop tile and Ecobase tiles, while Forbo Flooring in the UK also uses recycled content in tiles.

In terms of biobased materials, Jabro SmartStrand uses 37% Dow bio-polymers (PTT), Balta also has the Amaize product-line, made from corn using DuPont Sorona (<https://www.amaize.eu/en/amazingly/sustainable>) and although they claim reduced carbon footprint for the material inputs, the presence of this mixed with synthetic polymers will seriously inhibit end-of-life recycling. Bio-based materials are also no guarantee of non-toxicity as they can equally become toxic due to the use of hazardous additives.

A.1.7.4 A Life Cycle Analysis perspective on fibres

There is no specific Life Cycle Analysis (LCA) benchmark for carpet materials per se but it is perhaps useful to consider LCA analysis for fibres where used in another application, textiles. The Made-By Index for textile fibres is one guide⁵⁰, using LCA to identify fibre categories, A (best) to E (worst). Green House Gas emissions, Eco Toxicity and Human Toxicity are allocated a weight of 20% while the remaining parameters are given a weight of 13.33% - Energy, Water and Land Use. The benchmark takes into account the production process of natural fibres and man-made fibres but not the later processing stages or indeed end of life impacts.

In this analysis materials with high recycled content (mechanically and chemically recycled nylon and polyester/PET) score highly (A or B class) as do materials made of organic materials as may be expected, although it is important to note that the potential

⁴⁹ Eliminating Toxics in Carpet: Lessons for the Future of Recycling. Healthy Buildings Network, Oct 2017

⁵⁰ Made-By is an independent not for profit organisation working in the fashion industry: <http://www.made-by.org/consultancy/tools/environmental/>

of hazardous legacy chemicals is not considered in terms of the former. Natural materials such as conventional virgin wool and cotton do not come out well in this analysis, although the durability of wool is not taken into account. One problem with natural fibres is that they are difficult to recycle, since the fibres break down and get shorter and shorter with each cycle. This is why typically wool can only be recycled into felt.

A.1.7.5 Durability

Circularity essentially requires life extension of materials and is therefore about durability as well as reuse and recycling. The general life span of a carpet is about 5 to 15 years⁵¹; depending on the material, the density of pile, carpet design and use intensity, excluding factors like damage, change of taste or change of the facility's owner or usage.

In terms of construction, woven carpets can be very strong and hardwearing, hence their use in airports, hotels and cruise ships worldwide. Loop pile (where the fibre shows as a loop on top) is more hard-wearing than cut pile (where the loop is cut and tuft end exposed). Twist pile, where two fibres of the same or different colours are twisted together also offers greater durability (but complicates recycling where different fibre types are used). Dark and mixed colour carpets and those with random patterns are less likely to be ruined by small stains, also extending life.

Carpets also need to be as colour fast and stain resistant as possible and are often treated with a UV resistant and stain preventative treatment. Clearly this can result in legacy chemical impacts as discussed previously (see 4.0). Regarding colour fastness and stain resistance, technologies are being developed with nano-materials and the possible health impacts of these are not known (nano-particles being able to pass through a human cell membrane – see <http://www.centi.pt/>).

Wool and nylon carpets are the most hard-wearing carpets (they can be used for 15 years or more with regular cleaning) but also the most expensive. Polypropylene fibre (PP), offers end users qualities like low weight, colourfastness and resistance to moisture and staining. While quite hard-wearing, PP fibres are not as durable as nylon or polyester fibres, which makes them unsuitable for certain applications, such as extreme heavy-traffic commercial settings. Pure PP is often used in low wear areas such as bedrooms but would be less suitable for hallways which get more wear. Here a wool / PP blend may be used, typically 80% wool and 20% PP or other synthetic fibre, although this type of mixture is likely to inhibit recycling.

Pure wool and pure nylon tend only to be used in luxury and commercial applications in the EU. Sisal or Sea grass are also used for high quality carpets. Commercial carpets are, however, nearly always made of nylon and typically designed to last at least 7 years.

⁵¹ The UK Tenancy Deposit Scheme A guide to product lifespans, August 2017, suggests - Low quality – two to four years Medium quality – five to eight years Top quality – eight to fifteen years.

A.1.7.6 Reuse

Carpet reuse can eliminate the environmental impacts associated with new carpet manufacture, but reuse at scale is restricted due to the fact that broadloom carpet is generally fitted to a particular size and shape of room and hence any reuse requires fitting to a room of a smaller dimension. While reuse of broadloom carpet is therefore problematic to organise on a large scale, reuse of carpet tiles is far simpler as they can be more flexibly re-deployed. There are a wide range of case studies⁵²⁵³⁵⁴⁵⁵⁵⁶⁵⁷ in the UK and elsewhere, Interface being one of the best known examples. There are also good reuse opportunities in events carpeting although reuse appears to be rare.

The Interface TacTile no-glue installation carpet tile and the and TarkettTape™ System are important contributors to allowing reuse since carpet tiles are not stuck to the floor and hence are not damaged in removing them. It's interesting to note that the company's "Evergreen Lease" programme (for business), where Interface retained ownership of its carpet in customers' facilities, maintaining and reclaiming the tiles as necessary, was not a great success. This is reportedly the result, in part, of having to get customers to move floorcoverings over from capital (i.e. procurement) to operating budgets – which are generally different budget holders. The company still offers a free take back programme however.

A.1.7.7 Recyclability

The recyclability largely comes down to the design of the carpet to maximise the technical feasibility of fibre recovery at minimum cost and to produce fibres that are clean and have a strong secondary market so that the economics add-up overall. This in turn means:

- Single polymer design – face fibres and backing
- Easily separable face fibres and primary backing (the woven matrix) from secondary backing (the adhesive and filler part)
- Use of materials for which closed loop recycling is possible
- Information on the composition (materials and additives)
- Elimination of hazardous substances
- Easy installation and removal methods (without the use of permanent adhesives)

⁵² http://www.wrap.org.uk/sites/files/wrap/Non-clothing%20textiles%20report%20summary_0.pdf

⁵³ http://www.carpetrecyclinguk.com/downloads/Anglo_Social_Carpet_Tile_Reuse_Case_Study.pdf

⁵⁴ http://www.carpetrecyclinguk.com/downloads/Carpet_Tile_Recycling_Carpet_Tile_Reuse_Case_Study.pdf

⁵⁵ http://www.carpetrecyclinguk.com/downloads/Greenstream_Flooring_CIC_Carpet_Tile_Reuse_Case_Study.pdf

⁵⁶ http://www.carpetrecyclinguk.com/downloads/Spruce_Carpets_Carpet_Tile_Reuse_Case_Study.pdf

⁵⁷ <http://www.wrap.org.uk/sites/files/wrap/Collection%20of%20carpet%20tiles%20from%20businesses%20by%20processor.pdf>

Through the use of single polymers and/or more easily separable primary and secondary backing, and the elimination of hazardous chemicals, closed-loop recycling would become far more feasible (e.g. face fibre to face fibre or other high-value material). Due to the long life span of carpets, the decisions made today influence the recyclability of textile flooring in 5 to 15 years. In order to enhance the recyclability of carpets it is important to change the design and production standards now and to identify this new generation of carpets through use of appropriate tagging and information provision. A mandatory Product Information System (e.g. with an RFID-chip+Blockchain encryption) would allow 100% traceability of the materials present to assist recyclers, collectors and other stakeholders.

Some single polymer carpets already exist. Reeds Carpets (UK)⁵⁸ make 100% PP carpets for trade events and exhibitions without a secondary backing and take this back and recycle it, although they are not thought to reuse the carpets. Other event carpets are mostly disposed of to landfill or incineration after a very short use-phase (they are effectively disposable). Reed's single polymer approach allows fibre recycling. More generally, Niaga Mono is single polymer (<https://www.dsm-niaga.com/carpet/technology.html>), the Mohawk Everstrand Carpet claims to be engineered from one type of recycled PET (and can also be recycled⁵⁹) while the Mohawk Air.O, an entirely PET-based carpet, is also latex and VOC free, with a built in cushioning, and claimed to be fully recyclable.⁶⁰

Another major issue is that the backing is not made only of pure materials but is mixed with fillers. The backing and fillers are not meant to be separable and are generally bonded with latex. Some companies, including DSM – Niaga are now looking at means of reversible (heat-based) separation of the primary from the secondary backing (this may be through the use of a reversible heat melt as the adhesive.)

Carpet tile backings in the UK are still often bitumen based, with a minority being PVC and manufacturers are developing new types of tile backings to improve recyclability. Examples of this include Desso Ecobase[®], which uses a non-PVC, non-bitumen polymeric backing to increase recyclability.⁶¹

A.1.8 Existing Industry-wide Commitments

The European Plastics Industry Circular Economy Voluntary Commitments, Towards 50% Plastics Waste Recycling, includes a commitment from the EU carpet industry to:

⁵⁸ <http://www.reeds-carpets.co.uk/services/recycling/>

⁵⁹ <https://www.mohawkflooring.com/carpet/brand/everstrand>

⁶⁰ <http://www.floordaily.net/floorfocus/mohawk-introduces-airo-100-recyclable-easy-to-install-floorcovering-jan-2017>

⁶¹ Guidance on re-use and recycling of used carpets and environmental considerations for specifying new carpet

- set up an independent legal body, CRE (Carpet Recycling Europe) by June 2018, which will take care of circularity and sustainability challenges of the EU carpet sector.
- define polymer specific recycling targets in 2019, based on proven calculation models for future available waste streams and polymer contents in carpet waste by setting up a statistical information system targeting specifically at recycling related data.
- integrate with „Project 2020“ for the first time, circular economic and sustainability aspects like ease of installation, design for recycling and end of life performance into the ongoing CEN standardisation work.
- integrate this standardised information in the already existing voluntary carpet labelling system GUT-PRODIS (PRODUCT Information System) to allow a transparent communication to private and professional end-users.
- accompany these measures by independent verification processes and ongoing studies to develop the best available recovery technologies for polymers in PCCW.
- set up studies and projects to develop new production methods facilitating the recycling of our products concurrently assuring today’s high consumer safety standards.”

While this commitment is a step in the right direction, there is a strong concern that voluntary initiatives will not create a level playing field or generate the scale of infrastructure needed and will move too slowly where there aren’t the appropriate policy drivers, for example in the form of legislation or taxes.

A.2.0 Revised WFD Text on EPR Minimum Requirements

Article 8a General minimum requirements for extended producer responsibility schemes:

1. Where extended producer responsibility schemes are established in accordance with Article 8(1), including pursuant to other legislative acts of the Union, Member States shall: (a) define in a clear way the roles and responsibilities of all relevant actors involved, including producers of products placing products on the market of the Member State, organisations implementing extended producer responsibility obligations on their behalf, private or public waste operators, local authorities and, where appropriate, re-use and preparing for re-use operators and social economy enterprises; PE-CONS 11/18 MFG/NC/vm 49 DGE 1 EN (b) in line with the waste hierarchy, set waste management targets, aiming to attain at least the quantitative targets relevant for the extended producer responsibility scheme as laid down in this Directive, Directive 94/62/EC, Directive 2000/53/EC, Directive 2006/66/EC and Directive 2012/19/EU of the European Parliament and of the Council*, and set other quantitative targets and/or qualitative objectives that are considered relevant for the extended producer responsibility scheme; (c) ensure that a reporting system is in place to gather data on the products placed on the market of the Member State by the producers of products subject to extended producer responsibility and data on the collection and treatment of waste resulting from those products specifying, where appropriate, the waste material flows, as well as other data relevant for the purposes of point (b); (d) ensure equal treatment of producers of products regardless of their origin or size, without placing a disproportionate regulatory burden on producers, including small and medium-sized enterprises, of small quantities of products. PE-CONS 11/18 MFG/NC/vm 50 DGE 1 EN 2. Member States shall take the necessary measures to ensure that the waste holders targeted by the extended producer responsibility schemes established in accordance with Article 8(1), are informed about waste prevention measures, centres for re-use and preparing for re-use, take-back and collection systems, and the prevention of littering. Member States shall also take measures to create incentives for the waste holders to assume their responsibility to deliver their waste into the separate collection systems in place, notably, where appropriate, through economic incentives or regulations. 3. Member States shall take the necessary measures to ensure that any producer of products or organisation implementing extended producer responsibility obligations on behalf of producers of products: (a) has a clearly defined geographical, product and material coverage without limiting those areas to those where the collection and management of waste are the most profitable; (b) provides an appropriate availability of waste collection systems within the areas referred to in point (a); (c) has the necessary financial means or financial and organisational means to meet its extended producer responsibility obligations; PE-CONS 11/18 MFG/NC/vm 51 DGE 1 EN (d) puts in place an adequate self-control mechanism, supported, where relevant, by regular independent audits, to appraise: (i)– its financial management, including compliance with the requirements laid down in

points (a) and (b) of paragraph 4; (ii) the quality of data collected and reported in accordance with point (c) of paragraph 1 of this Article and with the requirements of Regulation (EC) No 1013/2006; (e) makes publicly available information about the attainment of the waste management targets referred to in point (b) of paragraph 1, and, in the case of collective fulfilment of extended producer responsibility obligations, also information about: (i) its ownership and membership; (ii) the financial contributions paid by producers of products per unit sold or per tonne of product placed on the market; and (iii) the selection procedure for waste management operators. PE-CONS 11/18 MFG/NC/vm 52 DGE 1 EN 4. Member States shall take the necessary measures to ensure that the financial contributions paid by the producer of the product to comply with its extended producer responsibility obligations: (a) cover the following costs for the products that the producer puts on the market in the Member State concerned: – costs of separate collection of waste and its subsequent transport and treatment, including treatment necessary to meet the Union waste management targets, and costs necessary to meet other targets and objectives as referred to in point (b) of paragraph 1, taking into account the revenues from re-use, from sales of secondary raw material from its products and from unclaimed deposit fees; – costs of providing adequate information to waste holders in accordance with paragraph 2; – costs of data gathering and reporting in accordance with point (c) of paragraph 1. This point shall not apply to extended producer responsibility schemes established pursuant to Directives 2000/53/EC, 2006/66/EC or 2012/19/EU; PE-CONS 11/18 MFG/NC/vm 53 DGE 1 EN (b) in the case of collective fulfilment of extended producer responsibility obligations, are modulated, where possible, for individual products or groups of similar products, notably by taking into account their durability, reparability, re-usability and recyclability and the presence of hazardous substances, thereby taking a life-cycle approach and aligned with the requirements set by relevant Union law, and where available, based on harmonised criteria in order to ensure a smooth functioning of the internal market; and (c) do not exceed the costs that are necessary to provide waste management services in a cost-efficient way. Such costs shall be established in a transparent way between the actors concerned. Where justified by the need to ensure proper waste management and the economic viability of the extended producer responsibility scheme, Member States may depart from the division of financial responsibility as laid down in point (a), provided that: (i) in the case of extended producer responsibility schemes established to attain waste management targets and objectives established under legislative acts of the Union, the producers of products bear at least 80 % of the necessary costs; PE-CONS 11/18 MFG/NC/vm 54 DGE 1 EN (ii) in the case of extended producer responsibility schemes established on or after... [date of entry into force of this amending Directive] to attain waste management targets and objectives solely established in Member State legislation, the producers of products bear at least 80 % of the necessary costs; (iii) in the case of extended producer responsibility schemes established before... [date of entry into force of this amending Directive] to attain waste management targets and objectives solely established in Member State legislation, the producers of products bear at least 50 % of the necessary costs, and provided that the remaining costs are borne by original waste producers or distributors. This derogation may not be used to lower the proportion of costs borne by producers of products under extended producer

responsibility schemes established before ... [date of entry into force of this amending Directive]. 5. Member States shall establish an adequate monitoring and enforcement framework with a view to ensuring that producers of products and organisations implementing extended producer responsibility obligations on their behalf implement their extended producer responsibility obligations, including in the case of distance sales, that the financial means are properly used and that all actors involved in the implementation of the extended producer responsibility schemes report reliable data. PE-CONS 11/18 MFG/NC/vm 55 DGE 1 EN Where, in the territory of a Member State, multiple organisations implement extended producer responsibility obligations on behalf of producers of products, the Member State concerned shall appoint at least one body independent of private interests or entrust a public authority to oversee the implementation of extended producer responsibility obligations. Each Member State shall allow the producers of products established in another Member State and placing products on its territory to appoint a legal or natural person established on its territory as an authorised representative for the purposes of fulfilling the obligations of a producer related to extended producer responsibility schemes on its territory. For the purposes of monitoring and verifying compliance with the obligations of the producer of the product in relation to extended producer responsibility schemes, Member States may lay down requirements, such as registration, information and reporting requirements, to be met by a legal or natural person to be appointed as an authorised representative on their territory. 6. Member States shall ensure a regular dialogue between relevant stakeholders involved in the implementation of extended producer responsibility schemes, including producers and distributors, private or public waste operators, local authorities, civil society organisations and, where applicable, social economy actors, re-use and repair networks and preparing for re-use operators. PE-CONS 11/18 MFG/NC/vm 56 DGE 1 EN 7. Member States shall take measures to ensure that extended producer responsibility schemes that have been established before ... [date of entry into force of this amending Directive], comply with this Article by ... [54 months after the date of entry into force of this amending Directive]. 8. The provision of information to the public under this Article shall be without prejudice to preserving the confidentiality of commercially sensitive information in conformity with the relevant Union and national law.

* Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) (OJ L 197, 24.7.2012, p. 38).;